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(19) (CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Device for the Loading of a Printing Press Inkwell

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SUMMARY

The invention concerns a device for charging an ink well on a printing press with ready-mixed ink. This ink is mixed continuously from its primary colours and delivered to the ink well, thus obviating the ink mixing step in the production planning for a print run. The components filled with mixed ink after a print run are designed as exchangeable parts. In this way equipment can be rapidly switched to another colour.

DESCRIPTION

The invention concerns a device for charging the ink wells on printing presses with an ink obtained by withdrawing the required volumes of various primary colours stored in containers, mixing them, and then discharging the mixed ink into the ink well.

Until now, printing inks for letter and rotary presses either had to be delivered ready-mixed to the desired colour by the ink manufacturer or had to be mixed before the start of printing outside the printing press. Rotary presses are often equipped with supply containers from which the ink can be automatically drawn into the inking devices in order to obviate manual filling of ink wells during operation.

When orders are processed, the required ink volume can usually only be estimated. As a result, there are frequently remnants or quantities of incorrectly mixed ink left over when the job is completed. Excess quantities of ink mixed to a specific nuance cannot be utilized and must be destroyed. Manual re-mixing is difficult in spite of extensive experience and good colour sensitivity and often results in undesirable colour changes. In addition, re-mixing interferes with the working process.

In addition to the problems of correct ink supply, the entire ink pathway within the printing press must be totally cleaned of ink at the end of a print run to ensure that the colour of the next print run is not compromised.

This cleaning process is time-consuming and utilizes hydrocarbons, the use of which is increasingly regarded as a liability. The work is dirty and associated with exposing the printers to cleaning agents that are often not entirely safe.

The purpose of this invention is to propose the charging of ink wells on printing presses by a device that would always provide continuous mixing of the ink to almost any desired nuance in the required amount, including instances where less or more ink than originally foreseen is utilized. The device would have to be designed in such a way that it can be rapidly re-set to another colour.

To resolve this objective, the invention proposes that at least one dosing device (2) be inserted after every container (1); that at least two dosing devices (2) be connected to a mixer (6); that every mixer (6) be connected to at least one ink well (10) for discharge of the ready-mixed ink; and that the components of the device that contain the ready-mixed ink consist of detachable, exchangeable parts.

The invention turns away from the preparation of inks by mixing outside the printing press in the preliminary stages of production planning, by contrast proposing that the ink be mixed continuously or in very small quantities on an ongoing basis from the required primary colours in amounts that correspond to the volume used.

This will resolve a problem that always arises in printing works when inks are used that diverge from the primary colours. The quantity of ink required for a print run can never be exactly estimated. The different surfaces of materials used for printing often result in significant variances in the required ink volume.

When ordering pre-mixed inks one must either take into account that large remnants may be left over, or risk running out of the appropriate ink. Resulting ink remnants are stored and must very often be discarded because the colour mixed for a specific job cannot be reused. This becomes an environmental liability and leads to financial loss. Problems also arise when a print run requires small amounts of a special colour: small volumes of such special colours are usually not supplied by the ink manufacturers and larger volumes have to be ordered, again resulting in significant remnants.

The device here invented resolves these problems by allowing special colours to be mixed from primary colours at a relatively continuous rate during printing; by interrupting this mixing process at the appropriate time towards the end of the print run, practically no residual ink will remain. By skillful use of the device it is possible to keep ink quantities in the ink wells extremely low to facilitate optimal utilization without residue. The quantity of ink mixed varies from about 0 to 100 grams per minute, depending on printing format and manuscript.

At the end of a print run, i.e. when the printing press has been stopped or when preparing the press for another print run with other colours, the cleaning expenditure is minimal. Parts wetted or filled with the mixed ink are exchanged, being designed as exchangeable parts which allows them to be either discarded, subjected to an environment-friendly recycling process, or put through a cleaning process outside the machine where the use of

cleaning agents is eliminated or minimized. Making these parts exchangeable also reduces the down times.

At room temperature, inks used in offset printing are of a pasty substance; their flow characteristics and thus also their miscibility is significantly improved by heating. A particularly efficient design of the invention therefore features a pre-heating area in conjunction with the mixer. The primary colour containers, the tubing that leads to the mixer, or the mixer itself can serve as pre-heating area; or the entire device can be installed in a housing which is completely heatable. Raising the temperature to 25°-40°C is sufficient to ensure that mixing results are considerably improved or more rapidly achieved. Since heating the dye can lead to colour changes, e.g. through evaporation of volatile components, the heating and mixing process is best carried out in a hermetically sealed environment. For this purpose the areas containing the heated ink are either completely encased in a housing that protects the ink from all air access, or the housing that covers these parts of the device is filled with inert gas. These measures permit heating the ink to 30°-50°C, thereby obtaining further improvement of the mixing results. Since the different viscosity of heated ink compared to cold ink can interfere with the printing process, it may be appropriate to install a cooler between the mixer and the ink wells in order to return the ink to room temperature.

Dosing of the primary colours is effected by piston-type dosing pumps (e.g. Orlita, Giessen), proportioning screw pumps or batch controlled chamber charging devices. An economical solution is

possible with manual or computer-controlled adjustable dosing and filling cylinders. These are cylinders with pistons that are filled through a three-way valve. By adjusting the three-way valve, the contents can be discharged in controlled doses in the direction of the mixer. This permits simultaneous discharge of contents (ink) from all cylinders, which results in better mixing in the mixer. It is advantageous to place the ink supply containers under light pressure by means of an inert gas to prevent any unwanted evaporation as a result of the suction effect of the dosing device. An alternative is to equip each container with a movable lid which is maintained under light pressure. The inert gas cushion or movable lid can also be used for the feed and dosing process; this will be further explained below in connection with the description of application examples.

Only parts that are wetted by job-specific inks, such as mixer, conduits and, where applicable, tubes, are replaced as exchangeable components after a colour change; these components may include simple check valves or valves with minimal opening pressure. Unaffected are the supply conduits used continuously to convey a specific colour from a primary colour container via the pump to the mixer. The exchangeable parts can naturally be either cleaned or recycled if made e.g. of synthetic materials soluble in weakly alkaline water, as currently available on the market.

It is appropriate to construct the mixer in such a way that a minimum of residue remains when the ink is discharged after mixing. This type of mixer design facilitates both recycling and

cleaning of exchangeable components by minimizing the residue of ink after use. Corresponding construction designs will be presented in conjunction with the description of application examples. These designs will in part suitable for recycling, in part for cleaning; however, all can in principle be used for either application.

It is possible to interconnect a large number of primary colour containers with dosing devices, mixers and ink wells in such a way that each inking device on a multi-colour press can be supplied with every possible colour mix and the ink flow controlled by adjustable valves. This system can be fed by a program that controls dosing and ink supply so that the machine always receives the necessary quantity of required special colours. After the print run, the parts contaminated by the mixed ink are simply exchanged. The next job using other special colours can then be printed with a minimum of delay.

It is also possible to connect each primary colour container to a single dosing device and install a shunt equipped with valves that do not affect the dosing between this dosing device and the various mixers. In this way it is possible to service several mixers from a single dosing device which can be switched from one mixer to another. Another possibility is to supply several mixers alternately with their required ink portions. The control valves must not affect the dosing. Suitable for the purpose are e.g. ball valves. The dosing devices may dispense the ink volumetrically or gravimetrically.

To facilitate complete discharge of the ink from the mixer, the internal space of the mixer should optimally consist of a cavity, the volume of which is essentially variable from 0 up. As an example, it can be designed as a squeezable section of tubing consisting of two mated, rectangular sheets of plastic foil heat-sealed along the edges.

The mixer can also be designed as a cylinder surrounding a movable, tightly sealed piston. In each case there are connecting nozzles on one side corresponding to the number of containers, while at least one nozzle is located on the other side of the mixer for connection to the intake mouthpiece on an ink well. In this way almost uninterrupted discharge is achieved. In the case of a cylindrical mixer, the connecting nozzles for the containers may e.g. be located at the cylinder base, while the connecting nozzle for the tube connection to the mouthpiece is located on the piston.

If the mixer consists of a squeezable tube section, this should preferably be inserted into a holder designed so that it has a support on one side, e.g. in the form of a plate, with a movable milling roller on the other side. The milling roller can be mechanically moved back and forth e.g. by use of a pneumatic cylinder. Alternatively, the support can be designed as a circular segment with the milling roller operating by a swinging circular motion.

With this type of design it is especially easy to install a conveying roller to effect the discharge of mixed ink from the mixer into the ink well. This roller moves along the same radius

as the milling roller. e.g. on a frame extended backwards over the milling roller's pivot point, which is then swivelled 180° to effect discharge of the ink. The conveying roller must be positioned on a longer radius on the frame, or the swivel axis of the frame must be temporarily moved closer to the mixer while the conveying roller works to discharge the ink. For thorough mixing, the milling roller, in contrast to the conveying roller, must not be allowed to compress the tube segment completely.

Another possibility is to design the milling roller with two disks positioned at a given distance from each other, so that space is created between the disks wherein the ink can flow contrary to the milling direction.

Depending on the consistency of the inks being mixed and the quantities required, it may be appropriate to equip the milling roller with a spiral ribbing to accomplish a lateral compression in addition to compression in the direction of rotation. In this design, the intake (connecting nozzles 5) and discharge (connecting nozzle 7) are laterally displaced. The pitch of the spiral can be adapted to the length of the mixer in such a way that the frame turns continuously, and the milling roller with each revolution covers the mixer so that its contents are forced both in the direction of the milling roller and laterally. This way the mixer contents are moved continuously, or in small portions with each motion of the milling roller, from intake to discharge. During this conveying process the ink is thoroughly mixed by intensive milling; the spiral must be dimensioned in accordance with the ink volume and the necessary mixing intensity.

Irrespective of the design of mixer and milling roller, it is appropriate to separate the nozzles for connecting the containers in the milling direction, and the nozzle that connects to the mouthpiece, by a distance equivalent to the milling area. In this way, thorough mixing is accomplished while emptying of the mixer is also facilitated. When a mixer designed as a tube section is used, the nozzles should preferably be located immediately at the front end in a lateral surface area, so that the two side walls are unimpeded by the nozzles and can lie totally flat against each other with an internal volume of 0.

Particularly thorough mixing of the inks entering the mixer is possible when a ferromagnetic body, especially a rod, is moved without contact by means of a permanent magnet which is turned or moved by a motor on the outside of the mixer. This causes vigorous milling and squeezing of the ink and results in excellent mixing. After use, the pin can very easily be removed from the mixer, e.g. by simply pushing it through the mixer membrane. In this way it is recoverable and reuseable.

A mixer may also consist of two rollers arranged side by side in parallel. These contra-rotating rollers are fully or almost in contact, the rotary motion converging at their top end. If inks to be mixed are applied to the upper end of the rollers, they will be thoroughly mixed in the wedge area formed at the upper end of the rollers. This results in wetting of the upper ends of the rollers, but the contact or very narrow gap between the rollers nevertheless prevents the ink from passing through. The ink is applied at one end of the roller pair and transported to the other end e.g. by tilting of the rollers, in the process being mixed and leaving the rollers at the other end as ready-

mixed ink. Instead of tilting the roller pair, the ink can also be transported to the discharge point by intermeshing spiral profiles. If such rollers are supported at one end only, and the support designed so that the rollers are easily removable, exchange of the rollers is easy and uncomplicated. Such rollers can be cleaned after removal, or can be made of recyclable plastic, or designed as disposables. In any case the replacement principle again reduces equipment down time when the press is switched from one colour to another.

The rollers can also be covered by exchangeable tubing. It is furthermore appropriate to cover the rollers by a housing designed either so that it becomes completely ink-filled when the inks for mixing are delivered, thus completely displacing the air from the mixer contents; or the housing may be filled with inert gas. This housing should also be exchangeable. The mixer contents delivered to the rollers can be pre-heated, or the rollers, the housing, or both can be equipped with heaters.

Ultrasound can be used to augment the mixing by attachment of a relatively low-performance ultrasound head to the mixer. If the inks are sufficiently thin, mixing by means of ultrasound alone will suffice; in such cases the appropriate temperature range is e.g. between 30° and 50°C.

It is not necessary for each batch first to be mixed and then emptied into the ink wells. On the contrary, it is preferable to work with continuous dosing of the mixed ink until, towards the end of a print run, the mixing tract needs to be emptied as completely as possible. Since a certain pressure is applied by

the dosing units, it is possible to adjust them for continuous operation where they dispense amounts sufficiently small to allow almost continuous delivery of the primary colours for mixing into the mixer. This accomplishes a constant, or near constant, discharge of mixed ink from the mixer and allows a constant outflow of mixed ink from the mouthpiece.

At least on large presses, a development of the invention permits the mouthpiece to slide along the ink well. This allows almost any desired colour intensity to be applied over the length of the ink well. In this manner, account is taken of situations where the printing requirements call for specific areas to receive more ink than others.

Continuous operation of the device is also possible with a cylindrical mixer with an internal piston which is maintained at a distance from the cylinder base and only allowed to move to the base of the cylinder when the mixer is to be completely emptied near the end of the print run. A mixer consisting of two rollers equalizes a certain discontinuity of dosing and ensures that a continuous amount of mixed ink leaves the mixer.

It is naturally feasible to connect several mixers to one mouthpiece, or several mixers and several mouthpieces, in order to supply an exceptionally long ink well. Again, when several mouthpieces are supplied from a single mixer, adjustable dosing can be used to control the distribution to individual mouthpieces and thereby to individual segments of the ink well.

At the beginning of a print run, the colour nuance required for each ink well is determined. It is assumed that the mixing proportions to achieve the desired nuance from the pertinent primary colours has been determined, e.g. by spectrophotometry or by using data from a computer program. After checking that the primary colours are available in adequate quantity within the containers, the dosing devices are set accordingly or the operating speed of drive motors commonly used on these dosing devices controlled by an attached microprocessor. The appropriate ink distribution along the length of the ink well is determined, thereby indirectly providing direction for positioning of the mouthpiece along the ink well. Alternatively, the ink well may be divided into segments where a minimum level indicator in each segment will signal an alarm that initiates immediate replenishment of the ink supply.

At the beginning of the print run, a fresh mixer and fresh tubes are inserted to make the equipment ready for operation. Before starting the printing press, the ink wells are pre-filled according to the required profile, or all sections filled to the minimum ink supply level. The printing press can then be started. During operation, ink is either supplied as programmed, or the minimum level indicators will call up ink according to use.

At the end of the print run, the ink wells are run dry according to experience, with all remnants having been drawn from the mixers. After shutdown of the press, the ink wells are cleaned in the usual manner, while each mixer and the tube connection to the mouthpiece is emptied and exchanged. The mouthpiece is emptied

and exchanged as required. These parts are cleaned, recycled or discarded, with disposable mouthpieces best designed to consist of a single valve that opens at a specific minimum pressure.

In the following, the forms of constructions shown in the drawings will be explained in detail. The drawings represent:

Fig. 1	A schematic representation of the invention in a first form of construction;
Fig. 2	A lateral view of a modified mixer;
Fig. 3	A schematic overview of the milling and conveying device in the form of construction shown in figure 2;
Fig. 4	A cross section through another form of construction of a mixer in accordance with the invention;
Fig. 5	A schematic cross section of a dosing chamber for dosing of ink in the mixer;
Fig. 6	An additional form of construction of a mixer similar to that in Fig. 2;
Fig. 7	A mixer consisting of two rollers; and
Fig. 8, 8a	an additional dosing chamber.

In Figure 1, a form of construction of the invention is shown schematically. It is self-evident that appropriate mountings for individual parts are present; nevertheless, since it is possible to select screw-on surfaces on existing printing presses, the illustration is therefore in each case limited to the component parts of the invention and not extended to include ancillary parts such as mountings, tube clamps etc.

Primary colour containers 1 are installed at suitable points; in Figure 1 a total of five containers are shown. Among primary colours is included a binding agent that is part of the ink recipe and also must be dosed in the prescribed amount. One can assume that 9 containers, including binding agent, suffice to mix all possible colour nuances. Located immediately below the container 1 are dosing devices 2, here shown only schematically. These may consist e.g. of piston-type dosing pumps having infinitely adjustable motors, or with the number of strokes being pre-set in order to provide a given dosage. There are naturally many suitable types of dosing and conveying devices. Below the dosing devices 2 are stopcocks or valves 3 serving as main valves to shut off the dosing devices 2 as well as the containers 1 from the environment. The containers 1 are hermetically sealed and under light pressure provided via a nitrogen or CO_2 conduit, not shown in detail, that opens into each container 1.

From each unit, a tube 4 leads from the container 1, the dosing device 2 and the valve 3 to a connecting nozzle 5 on a mixer 6. The primary colours (including binding agent) are supplied through the tube 4 to the mixer 6 which is designed as a squeezable section of tubing. Here it consists of a bottom foil and a top foil which are heat-sealed to each other along the edges. At one end the mixer 6 are located connecting nozzles 5; these are connected to the lower foil and are therefore turned away from the viewer and located below the plane of the projection. The same applies to a connecting nozzle 7 at the other end of the mixer 6. Connected to this nozzle is a tube 8 that conveys the mixed ink to a mouthpiece 9 which supplies the inking device 10 with ink.

The mixer 6 lies on a table (not shown) that has corresponding cutouts for the connecting nozzles 5 and 7. To prevent a reflux of ink from the mixer into the tube 4, non-return valves (not illustrated) that moreover require a certain minimum pressure to open, are integrated into the connecting nozzles 5. A similar valve is located in the area of the mouthpiece 9.

When the colours have been mixed in the mixer 6, which will be further described below, and after the ink has been discharged from the mouthpiece 9, the ink still has to be distributed within the inking device 10. For this purpose, a carriage 14 is provided that moves on a guide bar 15 along the inking device 10. The lateral motion is obtained by a screw 16 that is turned by means of a drive motor 17 and this rotation achieves the mentioned lateral motion via a nut (not shown) inside the carriage. The travel of the carriage 14 to individual positions is controlled either by a computer program or by dividing the inking device 10 into segments in which the ink requirement is signalled by means of a minimum level indicator. Such minimum level indicators are well known and therefore require no explanation at this point.

The device is ready for operation when the container 1 has been adequately filled, the dosing devices 2 programmed, the valves 3 for the required colours opened, and the tube 4 completely filled up to the connecting nozzles 5. Continuing discharge of primary colours into the mixer 6 results in it being slowly filled, with clear traces of the various colours being immediately discernible in the areas of the individual nozzles 5. Using

a milling roller 20, the mixer 6 is now repeatedly worked, mainly transversely to its throughflow direction, by means of a back-and-forth motion generated by a pneumatic cylinder 21 which drives the milling roller 20. This results in vigorous and adequate mixing of the individual primary colours and production of the required colour nuance. The milling roller 20 is adjusted so as not to compress the two foils that make up the mixer 6 completely, but to leave a certain passage during the milling in order that the primary colours introduced into the mixer 6 only mix, but are not extruded from the mixer 6.

Depending on the mode of operation or the desired operating process, the gradual continued dosing of primary colours will result in the mixer 6 reaching its maximum inflated volume. This produces an overpressure in the tube 8 which is sufficient to open the valve in the mouthpiece 9. Mixed ink is then discharged corresponding to the dosed volume of primary colours. Alternatively, the milling roller 20 can be lowered after a completed mixing cycle so that the two foils of the mixer 6 are compressed with no internal space remaining. This will result in an almost complete extrusion of the mixed ink from the mixer 6. Hence, when not lowered, the milling roller 20 produces a continuous discharge of mixed ink from the mouthpiece 9; lowering of the milling roller 20, results in intermittent emptying.

The nozzles 7 that connect the tube 8 to the mouthpiece 9 can naturally be placed to the left below the corner of the mixer 6 in order to accomplish as total a discharge of mixed ink as possible from the mixer 6, while appropriately a small amount of mixed ink will remain, thus preventing unmixed colours from

directly entering the tube 8 at the beginning of the mixing cycle.

In Figures 2 and 3, a further development of the invented device is shown wherein the milling roller 20 is moved in a different manner. The mixer 6, in the form of the described tubing segments, is not placed on a table but nestles along a support 27 designed as a circular segment. In the centre of the curvature, a spindle 26 supports a rotatable frame 25, at one end of which the milling roller 20 is located.

As clearly seen in Figure 3, the milling roller 20 can be made up of individual disks 28. Between them, areas of smaller diameter leave channels free during milling which allow the colours being mixed to flow against the milling direction. Figure 2 indicates that the frame 25 during mixing can be moved back and forth by means of a drive motor which is not shown in detail. In this way the milling roller 20 in principle intermittently traverses the mixer 6 along its entire length. This results in intensive mixing of the primary colours contained in the mixer 6.

It is clearly seen in Figure 2 that the tubes 4 and 8 start from the foil of the mixer (which is formed of two sheets of foil) that faces the circle segment-shaped support 27. Openings are provided through the support 27 for the nozzles 5,7 and the tubes 4,8. In this manner it is again possible to compress both foils to achieve an internal space with a volume that approximates 0.

For the purpose of intermittent emptying of the mixer 6, the frame 25 is swivelled 180° as indicated by the arrow, so that a conveying roller 24 located at the opposite end of the frame 25 can traverse the mixer 6 from its upper end downward. This ensures that its entire contents of mixed ink is discharged into the tube 8 and thereby via the mouthpiece 9 to the inking device 10 (compare Figure 1). The conveying roller should preferably consist of a medium hard rubber roller; usually it is sufficient for it to traverse the mixer once. The milling roller 20 is then again applied against the support 27, and the next mixing cycle can begin. A variation with a spiral-shaped milling roller has already been described; it is not illustrated here.

It is self-evident that both the functions of mixing and extrusion can be accomplished also with a solid roller, the distance of which to the support 27 can be varied. The mixer 6 is milled by maintaining the roller at a small distance; when the distance is eliminated, extrusion results. This mode of operation is also comparable to lowering of the milling roller 20 as shown in the form of construction in Figure 1.

In Figure 4 an additional form of construction is shown for a mixer in accordance with the invention. It consists of a cylinder 30 in which a piston 31 moves tightly. The connecting nozzles 5 for the tubes 4 (compare Figure 1) are located at the base of the cylinder, while the piston 31 is equipped with a corresponding connecting nozzle 7 for the tube 8. Between the piston 31 and the cylinder base is a mixing disk 33. Its guide bar 36 is routed hermetically through the piston 31. On the guide bar 36 there is an oscillating device which in addition can be rotated as

indicated, while the piston 31 can be mechanically operated or supported by means of a piston rod 32.

At the onset of colour mixing, primary colours are once again present under light pressure at each connecting nozzle 5. The mixing disk can lie flat against the inside of the piston 31, whereby openings 34 in the mixing disk 33 smoothly overlap elevations 35 on the piston 31. The unit formed by the mixing disk 33 and the piston 31 can be brought to a position where it rests on the cylinder base. As a result of the continuous dosing of primary colours at the beginning or preparation of a printing run, this unit is forced back until it reaches e.g. the position shown in Figure 4. At this point, the mixing disk 33 is moved back and forth by means of the guide bar 36, while the basic colours enclosed in the cylinder volume each time are forced through the openings 34. This results in vigorous mixing. When required, the mixing disk 33 can also be rotated in order to achieve even more intensive mixing; for mixing of the entire contents, the rotation can be adjusted in such a way that the elevations 35 always engage with the openings 34.

When ink is to be discharged from the mixer in accordance with Figure 4, the piston 31 is moved against the cylinder base by means of the piston rod 32, causing the mixed ink to discharge from the nozzle 7 into the tube 8 (compare Figure 1). Reflux through the nozzles 5 is again prevented by the non-return valve (not shown) located in each nozzle 5. At this point the ink chamber can optionally be totally evacuated, or a residue of mixed ink retained in the mixer 6. If total evacuation is desired, the mixing disk 33 must first be brought to its original

position where the openings 34 cover the elevations 35.

Naturally, this mixer also permits a continuous mode of operation, characterized by the pistons 31 being merely supported, and not moved, by the piston rods 32. The pressure exerted by incoming ink then results in continuous evacuation through the connecting nozzles 7, while the mixing disk 33 is moved back and forth continuously or at intervals.

It can be clearly seen that the mixer 6 as designed in Figure 4 is particularly easy to clean, since it can be completely dismantled and the dismantled components have no complicated cavities or undercuts. Accordingly, it can very easily be cleaned by rinsing. This mixer is also suitable for reuse, which nevertheless need not prolong the resetting time since the mixer can be exchanged and cleaned outside the machine.

The mixer 6, the tube 8 and the mouthpiece 9 can be so designed that they can be discarded upon colour change or after use. They must then be made of an inexpensive synthetic material that can be destroyed without detriment to the environment although resistant to inks and solvents, while subject to no other specific requirements. If it should happen that residual inks from the preceding batch remain in the area of the non-return valve at the end of the tubes 4, these tubes 4 must also be exchanged, including their built-in non-return or check valves. Since the pipes are extremely thin, both the ink loss and the resulting waste is minimal.

In the event that leakage problems occur at the gasket between the guide bar 36 and the piston 31 due to a film of dried ink, it can be replaced by a sleeve or sock which will prevent these problems. The same also applies to the gasket between the piston 31 and the cylinder 30.

A dosing chamber 40 is shown in Figure 5 that could serve e.g. as the dosing device 2 (Figure 1), i.e. in a number corresponding to the number of containers 1. For it to function, the inks in the containers 1 must be lightly pressurized, either by a cushion of inert gas or by a mechanically descending lid with a sliding seal.

The dosing chamber 40 is separated into two chamber segments by a divider 41, with the lower chamber segment featuring an adjustment screw 42. The adjustment screw 42 is surrounded by a metallic bellows 43, attached on the one side to a disk 39 resting on the adjustment screw 42, and on the other side to the interior of the chamber 40, its metallic construction providing it with adequate pressure resistance.

A feed line 44 emanating from a ball valve 45 with an L-passage leads to each chamber segment. Connected to the ball valve 45 is a supply line 46, attached e.g. directly to a container 1 (Figure 1). In the same manner, each chamber segment is connected to one of the discharge tubes 47, all of which are attached to a joint ball valve 48. From this ball valve 48, a tube 4 leads to the mixer 6. This ball valve also has an L-passage and is

mechanically joined with the above mentioned ball valve 45 to the common switch, which, however, is not shown in Figure 5.

Before the colours are added, the individual dosing amounts are set with the adjusting screw 42. This determines the free passage of the divider 41 within the chamber 40, so that a specific amount of ink leaves the chamber 40 with a single stroke along its remaining length. Both segments of the chamber 40 are then set so that the desired ink is added when each chamber segment has discharged the volume equivalent to one stroke of the divider 41.

In Figure 5, the end of a dosing stroke is shown with the lower chamber segment being emptied, i.e. the ink entering from the supply line 46 has flowed into the upper chamber segment, moving before it the divider 41 to the point where it touches the adjustment screw 42. The ink present in the lower chamber segment moves via the ball valve 48 into the tube 4 and thus to the mixer 6.

For the next dosing stroke, both ball valves are moved so that the other line 44 and 47, respectively, connects to the other chamber segment of the chamber 40. The ink then flows into the lower chamber segment, while the upper chamber segment empties into the tube 4 via the discharge tube 47. Each of these dosing chambers of the chamber 40 can deliver to a mixer of almost any construction, with the inflowing colours being mixed in the manner described, or in a manner to be described below.

Figure 6 serves to illustrate how particularly efficient mixing

can be achieved within a mixer 6 by means of a ferromagnetic pin 50 which is moved inside the mixer 6 by a permanent magnet 51. The permanent magnet 51 is moved back and forth around a central point M, which at the same time is the central point of the circular segment of the support 27, in a manner similar to the motion of the frame 25 described in connection with the form of construction shown in Figures 2 and 3. The pin 50, moved by means of the permanent magnet 51, causes vigorous milling, squeezing and consequently mixing of the inks contained in the mixer 6, so that a few back and forth motions suffice to ensure satisfactory mixing of the colours.

Figure 6 shows schematically how spring-loaded non-return valves are installed in the nozzles 5 and 7. In other respects, this form of construction is similar to that described in Figures 2 and 3. The mixer 6 thus consists of two superimposed sheets of foil. Corresponding welds are indicated in Figure 6.

Mixing of the inks can be supported by an ultrasound head 53 attached to the back of the support. It causes vibrations in the entire support 27 which are transmitted to the inks. If the inks are heated until they are very thin, mixing by means of ultrasound is in itself sufficient, and the ferromagnetic pin 50 and permanent magnet 51 can be dispensed with. All that is required is then a conveying roller 24 (Figures 2 and 3) in order to evacuate the mixer after mixing.

In the forms of construction shown in Figures 2 and 6, the ink can naturally in principle also be moved transversely to the mixing motion. This occurs when the inks enter at the one lateral wheel of the support 27 and the mixed ink is discharged at the

other lateral wheel. The ink then moves towards, respectively away from, the observer.

Figure 7 shows a mixer 6 consisting of two rollers 60 and 61. These rollers 60,61 are arranged in parallel side by side, almost or actually in contact. The rollers 60,61 are contrarotating, with the rotation converging at the top. The rollers 60,61 are connected to the drive by mountings 65,66 in such a way that they can be simply removed for exchange purposes. A horizontal inclination around the angle ensures that the inks introduced at one end of the rollers in the area 62 slowly flow in the direction of the arrow 63 to the other end of the rollers, in the process becoming mixed and leaving the mixing device in the direction of the arrow 64. By chamfering or ridges at this end of the rollers 60,61, the ink discharge is defined and contamination of the back of the rollers prevented. Through the rotary motion of the rollers, the ink introduced into area 62, consisting of at least two primary colours, is intensively kneaded between the rollers, while the distance between the rollers at their line of contact 68 is zero or minimal, thus preventing the ink from dripping through. Together with the viscosity of the ink, the inclination of the rollers through the angle determines the flow velocity. In this manner, optimal mixing results are achieved with the appropriate roller length. The rollers can be exchanged upon colour change and, if applicable, be cleaned or covered with an exchangeable cover that is replaced when the colour is changed.

It is appropriate to enclose the rollers 60,61 in a housing, which is not shown here. This housing should also be exchangeable. To achieve better mixing results, the rollers or the housing or both can be heatable. It is also possible to

suspend the rollers horizontally and equip them with a spiral profile, intermeshing along the line of contact, by means of which the ink is moved towards the discharge end (not shown).

Figures 8 and 8a show a dosing device intended for dosing the primary colours drawn from a container for delivery to the mixer. This dosing device consists of a cylinder 70 inside which a tightly sealed piston 71 moves. The piston 71 is driven by a rod 72 which leads into the cylinder 70. At the other end of the cylinder 70, a connection 77 leads to a three-way valve 76 which is connected to a container 1 (tube 74) and the mixer 6 (tube 75) via its two other exits.

Figure 8a shows the position of the three-way valve in a situation where the primary colour has been aspirated by the piston 71 through the tubes 74 and 77 until the piston 71 reaches a defined end position. The three-way valve then switches over and in this position, as shown in Figure 8, leads the ink via the pipe 75 to the mixer. The discharge volume is determined by the stroke and velocity of the piston.

Operation of the invented device is especially efficient when all settings and manipulations as well as all moving sequences, such as swivelling of the arm 25, activation of the conveying roller 24 and activation of the milling roller 20, are controlled as they recur. All movements can then at all times be controlled e.g. via servo motors with adjustable stop switches to ensure that defined return distances are covered. This allows a fully automated mode of operation which can be reproduced at will by

means of a specified program or according to an empirically developed program, e.g. for repeat orders. To this end, the adjusting screw 42 as shown in Figure 5 can, for instance, be mechanically adjusted and controlled. The valves in Figure 1 are also designed as magnetic valves, or similar, in order that the selection of colours also can be programmed. The programmability of the dosing units 2 has already been mentioned in the text above. For the professional it poses no difficulty to provide servo motors or very exact time-controlled valves that also permit dosing at a constant pressure. Such dosing devices are in common use, e.g. in fuel injection equipment on automobiles.

Before a printing press can operate at full speed, the supply devices and, where applicable, the interlinking e.g. of printed sheets of carton, must be set up and adjusted. During this process, a relatively large number of thoroughly usable copies are generated which, although deriving from the adjustment run, fully meet the quality requirements. Due to the slower operation of the machine, significantly less printing ink per time unit is used at this stage than during subsequent full-speed operation. Dosing must likewise be adjusted. It is therefore an advantage if in these situations the speed of ink mixing can be adapted to the speed of the printing press. This is especially simple if the dosing devices consist of piston pumps or screw conveyors that determine the dosing respectively by number of strokes or basic speed. These can be adapted to the operating speed of the machine, while a proportional speed controller ensures that the mixing speed is adjusted.

Claims:

1. In a printing press having an ink duct and containers for storing inks of a plurality of primary colors, an apparatus for filling the ink duct with given amounts of the inks being drawn from the containers, mixed and fed to the ink duct, comprising removable and interchangeable components containing mixed ink, said components including at least one metering device connected downstream of each respective container; and at least one mixer each communicating with at least two of said metering devices and with at least one ink duct for dispensing mixed ink.

2. Apparatus according to claim 1, including a warmup zone connected upstream of said at least one mixer.

3. Apparatus according to claim 2, wherein said warmup warmup zone heats the ink to substantially between 25 and 40°C.

4. Apparatus according to claim 2, including a housing surrounding said warmup zone and said at least one mixer and holding the ink in a hermetically sealed manner.

5. Apparatus according to claim 4, wherein said housing is filled with inert gas.

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6. Apparatus according to claim 4, wherein said warmup warmup zone heats the ink to substantially between 30 and 50°C.

7. Apparatus according to claim 2, including a cooler disposed between said at least one mixer and the ink duct.

8. Apparatus according to claim 1, wherein said removable and interchangeable components are at least partially formed of recyclable plastic.

9. Apparatus according to claim 8, wherein said recyclable plastic is soluble in an aqueous, weakly alkaline solution.

10. Apparatus according to claim 1, wherein at least some of said removable and interchangeable components are disposable.

11. Apparatus according to claim 1, including at least one mouthpiece for respectively feeding the ink from said at least one mixer into an ink duct.

12. Apparatus according to claim 11, including means for movably guiding said at least one mouthpiece along the ink duct.

13. Apparatus according to claim 1, including means having controllable valves regulating ink flow for interlinking

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communications among the containers, said at least one metering device, said at least one mixer and the ink ducts and supplying each inking unit of a multi-color printing press with any possible color or ink mixture.

14. Apparatus according to claim 1, including ink lines each being connected between a respective one of said at least one metering device and a respective one of the containers, said ink lines each having a branch between said one metering device and said one mixer with a controllable valve having no affect on metering.

15. Apparatus according to claim 14, wherein said controllable valves are ball valves.

16. Apparatus according to claim 1, wherein said at least one metering device meters volumetrically.

17. Apparatus according to claim 1, wherein said at least one metering device meters gravimetrically.

18. Apparatus according to claim 11, wherein said at least one mixer has sides, a number of connection sleeves on one of said sides being equal to the number of containers, and one connection sleeve on the other of said sides to be connected to said at least one mouthpiece.

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19. Apparatus according to claim 1, wherein said at least one mixer is a bag segment to be rolled out.

20. Apparatus according to claim 19, including a holder having sides and receiving said bag segment, an abutment attached to one of said sides, a rolling pin attached to the other of said sides, and a motor for moving said rolling pin.

21. Apparatus according to claim 20, wherein said abutment is a plate having the shape of a circular segment and defining a path in the shape of a segment of a circle over which said rolling pin moves.

22. Apparatus according to claim 20, wherein said bag segment has a number of first connection sleeves being equal to the number of containers and one second connection sleeve leading to the ink duct, said rolling pin moves in a given direction over a rolling-out zone, and said first connection sleeves are disposed at a distance from said second connection sleeve being equivalent to said rolling-out zone, as seen in said given direction.

23. Apparatus according to claim 20, wherein said rolling pin includes disks being mutually spaced apart.

24. Apparatus according to claim 20, wherein said bag segment has a ink inlet and an ink outlet being laterally

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offset from one another, and said rolling pin has a rib in the shape of a helical line.

25. Apparatus according to claim 24, wherein said helical line has a pitch being matched to the length of said bag segment, and said rolling pin continuously transports material to be mixed in a rolling direction of said rolling pin and laterally from said ink inlet to said ink outlet.

26. Apparatus according to claim 20, including a transport roller being selectively movable instead of said rolling pin for evacuating said bag segment.

27. Apparatus according to claim 1, wherein said at least one mixer includes a cylinder having a cylinder bottom, a piston sliding sealingly in said cylinder, first connection sleeves connected between said cylinder bottom and the containers, and a second connection sleeve connected between said piston and the ink duct.

28. Apparatus according to claim 27, including a mixing disk movably guided between said cylinder bottom and said piston, and at least one actuating rod of said mixing disk being sealingly guided completely through said piston.

29. Apparatus according to claim 27, including a mixing disk movably guided between said cylinder bottom and said piston, and at least one actuating rod of said mixing disk

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being sealingly guided completely through said cylinder bottom.

30. Apparatus according to claim 27, including a motor for driving said piston into said cylinder and evacuating said at least one mixer.

31. Apparatus according to claim 1, including a ferromagnetic body disposed in said at least one mixer, and a magnet disposed outside said at least one mixer for moving said ferromagnetic body.

32. Apparatus according to claim 31, wherein said ferromagnetic body is a bar.

33. Apparatus according to claim 31, wherein said magnet is a permanent magnet.

34. Apparatus according to claim 31, wherein said magnet is an electromagnet.

35. Apparatus according to claim 1, wherein said at least one mixer has an interior enclosing a volume being variable from a value substantially equal to zero.

36. Apparatus according to claim 21, including means for causing ink to flow to the ink duct as a consequence of a volumetric flow transported into said at least one mixer

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from said at least one metering device, rather than by means of a reduction in volume of said at least one mixer.

37. Apparatus according to claim 27, including means for causing ink to flow to the ink duct as a consequence of a volumetric flow transported into said at least one mixer from said at least one metering device, rather than by means of a reduction in volume of said at least one mixer.

38. Apparatus according to claim 31, including means for causing ink to flow to the ink duct as a consequence of a volumetric flow transported into said at least one mixer from said at least one metering device, rather than by means of a reduction in volume of said at least one mixer.

39. Apparatus according to claim 1, including supply lines leading from said at least one metering device to said at least one mixer, and check valves each being disposed immediately upstream of said at least one mixer in a respective one of said supply lines.

40. Apparatus according to claim 1, including supply lines leading from said at least one metering device to said at least one mixer, and valves opening at a predetermined minimum pressure each being disposed immediately upstream of said at least one mixer in a respective one of said supply lines.

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41. Apparatus according to claim 11, including a valve being disposed immediately upstream of said at least one mouthpiece for opening at a predetermined minimum pressure.

42. Apparatus according to claim 1, wherein said at least one mixer includes a pair of cylinders having ends, being parallel to and rotating contrary to one another as viewed from above and defining a zone of contact therebetween; and means for applying inks of primary colors from above in the vicinity of one of said ends of said cylinders in said zone of contact, means for transporting the inks to the other of said ends of said cylinders while being rolled out thoroughly, and means for delivering the inks from said cylinders at said other ends in the form of mixed ink.

43. Apparatus according to claim 42, wherein said cylinders completely contact one another.

44. Apparatus according to claim 42, wherein said cylinders nearly contact one another.

45. Apparatus according to claim 42, wherein said at least one mixer has an outlet side at said other ends of said cylinders, and said cylinders are inclined toward said outlet side by a given angle for transporting material to be mixed at a transport speed permitting an optimal mixing outcome.

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46. Apparatus according to claim 42, wherein said at least one mixer has an outlet side at said other ends of said cylinders, and said cylinders have helical profiles meshing with one another in a line of contact for transporting material to be mixed to said outlet side.

47. Apparatus according to claim 42, wherein said cylinders have journals at only one end thereof, and said journals have means for easily removing said cylinders for exchange.

48. Apparatus according to claim 42, including an interchangeable covering disposed on said cylinders.

49. Apparatus according to claim 42, including a housing surrounding said cylinders.

50. Apparatus according to claim 49, wherein said housing is interchangeable.

51. Apparatus according to claim 42, including means for heating said cylinders.

52. Apparatus according to claim 42, including supply lines leading from said at least one metering device to said at least one mixer, and means for heating said supply lines.

53. Apparatus according to claim 1, wherein said at least one metering device includes a chamber, and a divider disk

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in said chamber dividing said chamber into two partial chambers, said divider disk being movable over an adjustable length of motion in said chamber, and said partial chambers each having an ink supply line and an outflow line.

54. Apparatus according to claim 53, including a set screw for limiting a displacement path of said divider disk.

55. Apparatus according to claim 54, including a bellows separating said set screw from the ink.

56. Apparatus according to claim 1, including an ultrasound generator having a given range of influence, said at least one mixer being mounted within said given range of influence.

57. Apparatus according to claim 1, including means for separately heating said at least one mixer to an elevated temperature.

58. Apparatus according to claim 1, including a memory for storing and calling up adjusting values of said at least one metering device and all other adjustments and courses of motion for repeating a printing job.

59. Apparatus according to claim 11, including a memory for storing and calling up adjusting values of said at least one metering device, various positions of said at least one

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mouthpiece and all other adjustments and courses of motion for repeating a printing job.

60. Apparatus according to claim 1, including means for adjusting a mixing speed and all other motions in proportion to the speed of the printing press.

61. Apparatus according to claim 1, wherein said at least one metering device includes a cylinder; a piston disposed in said cylinder having a stroke and a speed for adjusting a metering quantity; and a three-way valve communicating with said cylinder, with a container and with said at least one mixer; said three-way valve including means for opening communication between the container and said cylinder to establish suction by said piston and for subsequently closing communication.

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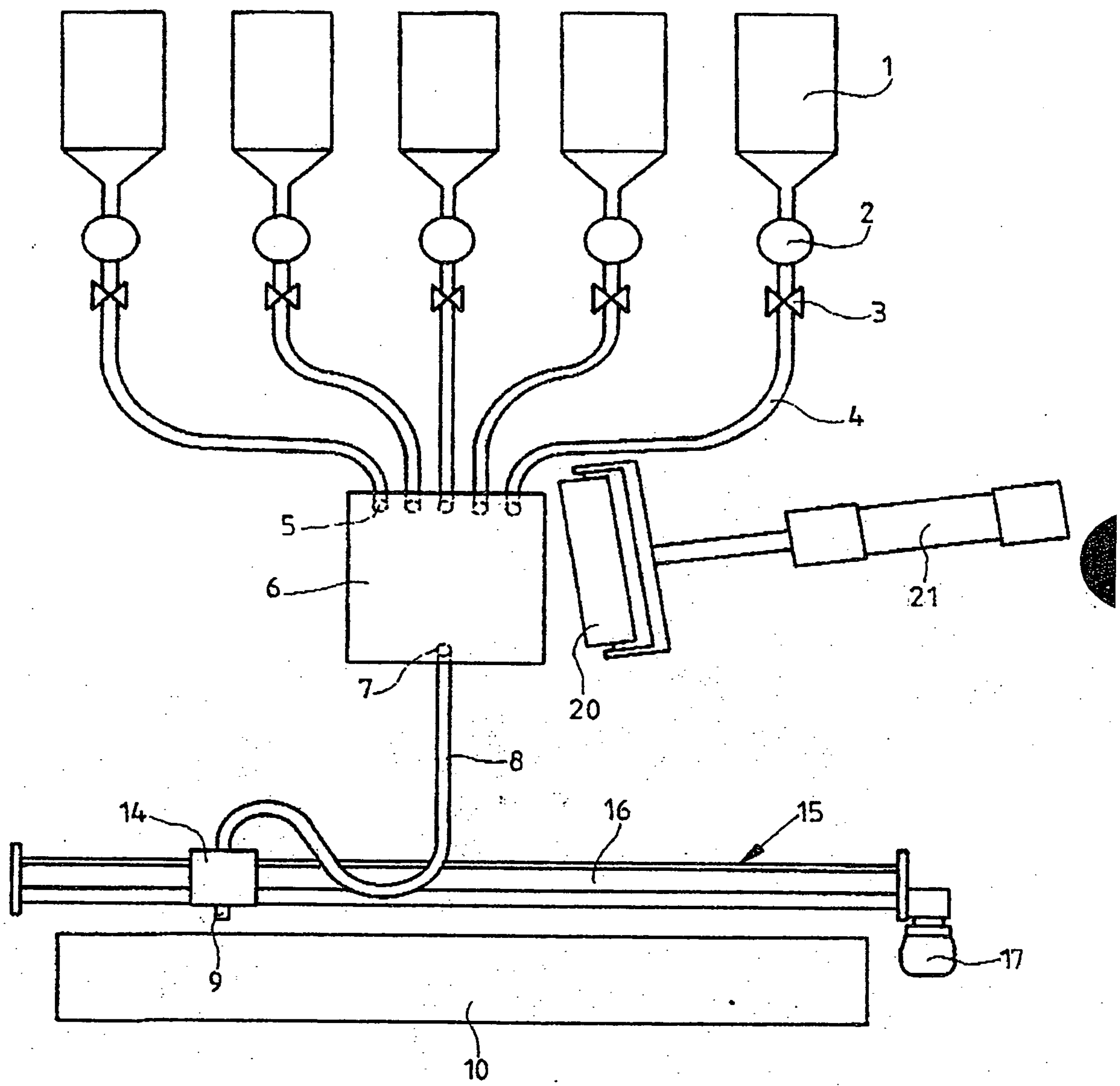
Fig. 1



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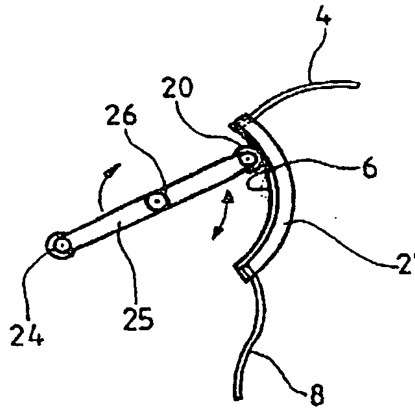

Fig.2

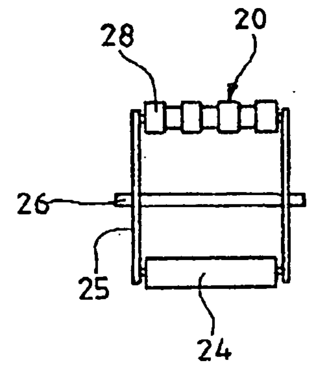

Fig.3

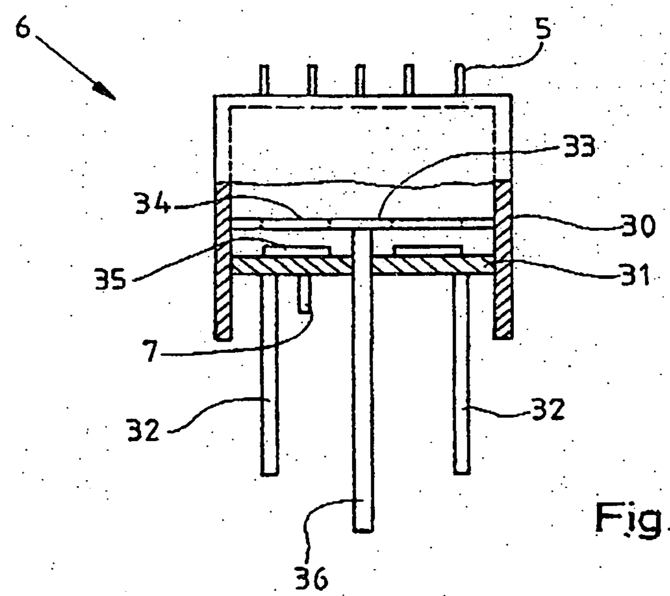

Fig.4

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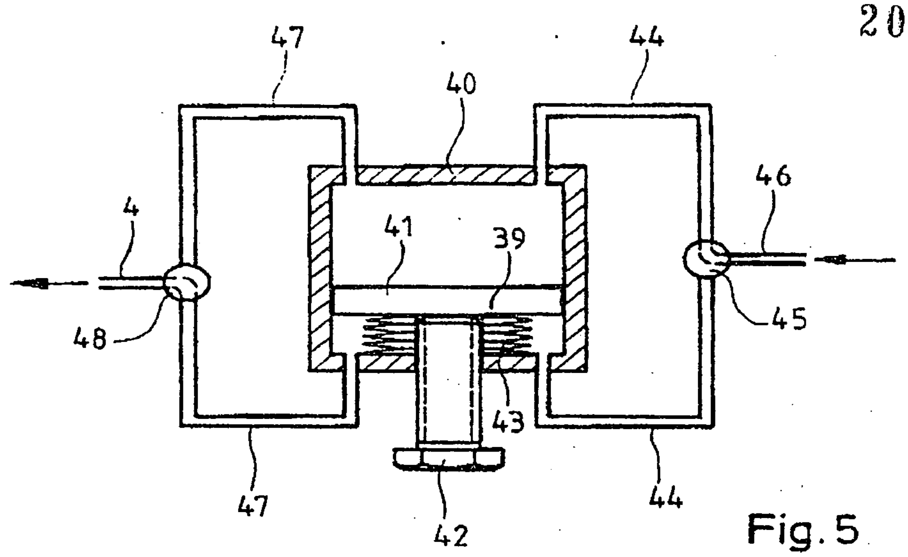

Fig. 5

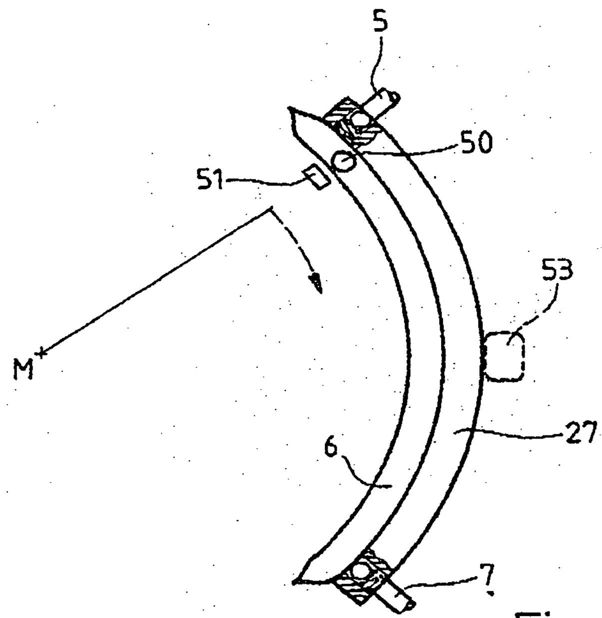

Fig. 6

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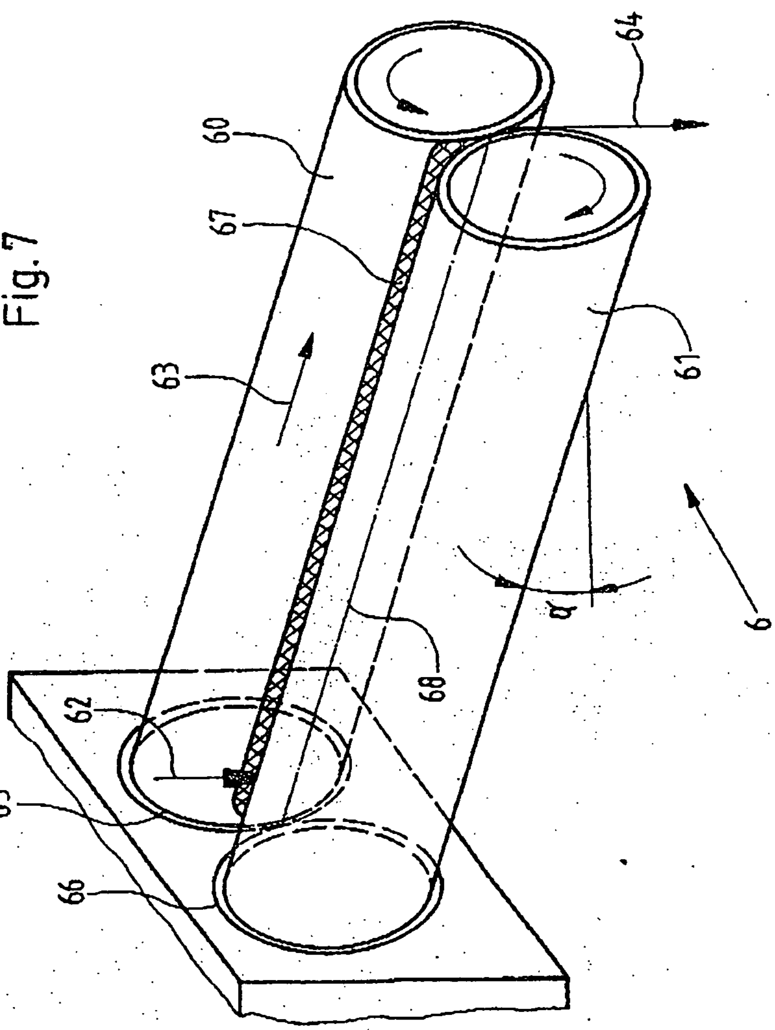

Fig.7

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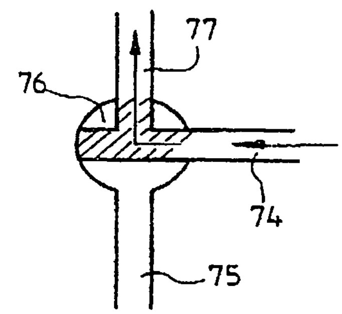

Fig.8a

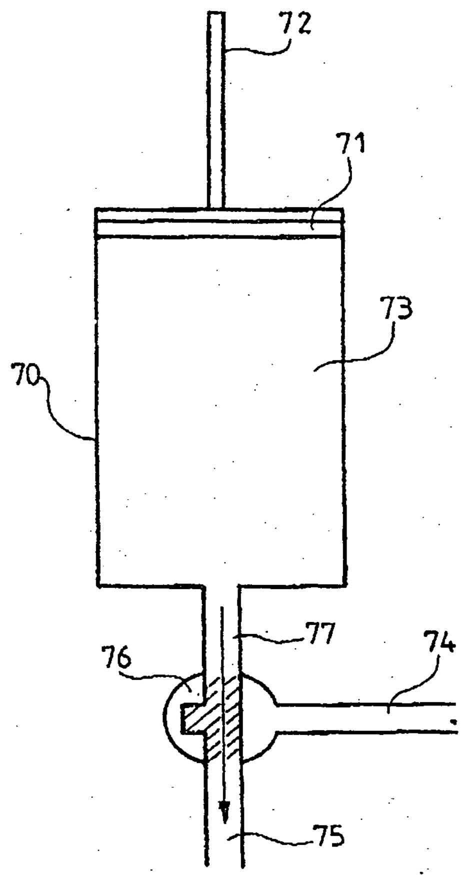

Fig.8

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Deutsches Patent- und Markenamt

München, den 09.09.2003
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Ihr Zeichen: 03936/DE/VH

Ihr Antrag vom: 24.03.2003
auf Recherche gemäß §43 Patentgesetz

Deutsches Patent- und Markenamt · 80297 München

Heidelberger Druckmaschinen
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Kurfürsten-Anlage 52-60
69115 Heidelberg

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Recherchebericht

A. Klassifizierung des Anmeldungsgegenstandes nach der Internationalen Patentklassifikation (IPC)

IPC 07
B 41 F 31/02

B. Recherchierte Gebiete

Klasse/Gruppe	Prüfer	Patentabteilung
B 41 F 31/02	ALFRED-MICHA WEBER	27

B 41 F 31/00 B 41 F 31/02 B 41 F 31/03 B 41 F 31/04 B 41 F 31/05

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Kat.	Ermittelte Druckschriften	Erläuterungen	Betr. Ansprüche	IPC / Fundstellen
D,A	DE 41 16 989 A1	Fig.1,2	1	B 41 F 31/02
A	DE 41 16 988 A1	Fig.1-4	1	B 41 F 31/02
D,A	DE 40 19 608 A1	Fig.1-8	1	B 41 F 31/02
D,Y	DE 39 33 388 A1	Fig.1-3	1	B 41 F 31/02
Y	JP 57-1 35 175 A	ges.Schrift	1	B 41 F 31/02

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E. Datum des Abschlusses der Recherche 04.09.2003

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Absendedatum des Rechercheberichtes

Anlagen: 5

Patentabteilung 1.11
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Docket # A-3936

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